FREEWAY WEAVING WORKSHEET

General Information

Analyst	
Agency/Company	AECOM
Date Performed	
Analysis Time Period	AM

Site Information

Freeway/Dir of Travel	I-95 NB
Weaving Segment Location	Seg 1-Bet Copans & Sample
Analysis Year	2020 Build 2A

Project Description SW 10th Street SIMR

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	4	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	2380ft	Freeway maximum capacity, C_{IFL}	2400
Freeway free-flow speed, FFS	70 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	4305	0.95	3	0	1.5	1.2	0.985	1.00	4600
V_{RF}	355	0.92	2	0	1.5	1.2	0.990	1.00	390
V_{FR}	790	0.92	2	0	1.5	1.2	0.990	1.00	867
V_{RR}	0	0.95	0	0	1.5	1.2	1.000	1.00	0
V_{NW}	4600							V =	5857
V_W	1257								
VR	0.215								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	1257 lc/h
Interchange density, ID	0.7 int/mi	Weaving lane changes, LC_W	1692 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	1467 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	3159 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	766

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	5777 veh/h	Weaving intensity factor, W	0.283
Weaving segment capacity, c_w	8765 veh/h	Weaving segment speed, S	54.7 mph
Weaving segment v/c ratio	0.659	Average weaving speed, S_W	57.9 mph
Weaving segment density, D	26.8 pc/mi/ln	Average non-weaving speed, S_{NW}	53.9 mph
Level of Service, LOS	C	Maximum weaving length, L_{MAX}	4686 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-95 NB*
Agency or Company	*AECOM*	From/To	*Seg 2-Bet Off & On from Sample*
Date Performed		Jurisdiction	
Analysis Time Period	*AM*	Analysis Year	*2020 Build 2A*

Project Description *SW 10th Street SIMR*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4660*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1660*	pc/h/ln
S	*67.5*	mph
D = v_p / S	*24.6*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

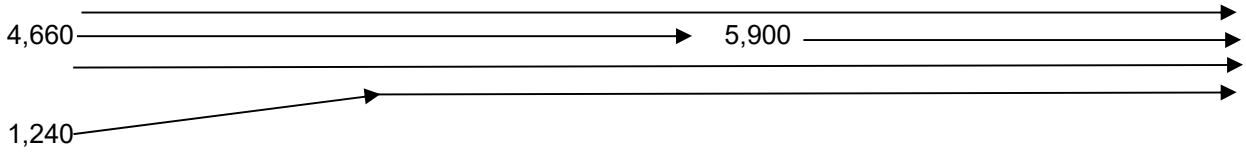
N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Job: SW 10th Street SIMR
Analyst: AECOM

Location: **Seg 3: I-95 Northbound On-Ramp from WB Sample Road**
Analysis Period: **AM Peak Hour**
Analysis Year: **2020 Build 2A**



	PHF =	**0.95**		
	v_{fr} =	**5,900**	vph	
	v_r =	**1,240**	vph	
	v_f =	**4,660**		
Upstream Freeway	**Tr % =**	**3%**		
Ramp	**Tr % =**	**2%**		
Downstream Freeway	**Tr % =**	**3%**		
Freeway	**f_{HV} =**	$1/(1+P_T(E_T-1)+P_R(E_R-1))$ =		**0.985**
Ramp	**f_{HV} =**	$1/(1+P_T(E_T-1)+P_R(E_R-1))$ =		**0.9901**
flat terrain	**E_T =**	1.5		
	RV % =	0		
Driver Population adj.	**f_P =**	1.000		
	V_{fr} =	$=v_{fr}/(PHF)(f_{HV})(f_P)$ =	**6,304**	**pc/h**
	V_r =	$=v_r/(PHF)(f_{HV})(f_P)$ =	**1,318**	**pc/h**
	V_f =	$=v_f/(PHF)(f_{HV})(f_P)$ =	**4,979**	**pc/h**
No. lanes upstream of ramp	**N =**	**3**		

No. Ln	**Capacity Check (see Exhibits 25-3 and 25-7):**	Maximum	Actual	V/c	LOS F?
4	Fwy downstream of ramp (assume 70 mph free-flow speed) =	9,600	6,304	0.66	No
3	Fwy upstream of ramp (assume 70 mph free-flow speed) =	7,200	4,979	0.69	No
1	Capacity on On-Ramp (assume 45 mph free-flow speed) =	2,100	1,318	0.63	No

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-95 NB
Agency or Company	AECOM	Junction	Seg 4-On from Exp
Date Performed		Jurisdiction	
Analysis Time Period	AM	Analysis Year	2020 Build 2A

Project Description SW 10th Street SIMR

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	4	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	1	☑ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A	1500	☐ No	☑ Off
L_{up} =	ft	Deceleration Lane Length L_D		L_{down} =	2950 ft
V_u =	veh/h	Freeway Volume, V_F	5900	V_D =	250 veh/h
		Ramp Volume, V_R	710		
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	50.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5900	0.95	Level	3	0	0.985	1.00	6304
Ramp	710	0.92	Level	2	0	0.990	1.00	779
UpStream								
DownStream	250	0.92	Level	2	0	0.990	1.00	274

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.120 using Equation (Exhibit 13-6)

V_{12} = 759 pc/h

V_3 or V_{av34} 2772 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes,V_{12a} = 2521 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	7083	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3602	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = 25.4 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.314 (Exibit 13-11)

S_R= 61.2 mph (Exhibit 13-11)

S_0= 65.9 mph (Exhibit 13-11)

S = 63.4 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-95 NB
Agency or Company	AECOM	Junction	Seg 5-Off to Exp from GPL
Date Performed		Jurisdiction	
Analysis Time Period	AM	Analysis Year	2020 Build 2A

Project Description SW 10th Street SIMR

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	4	Downstream Adj Ramp	
☑ Yes	☑ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☐ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	2950 ft	Deceleration Lane Length L_D	200	L_{down} =	ft
V_u =	710 veh/h	Freeway Volume, V_F	6610	V_D =	veh/h
		Ramp Volume, V_R	250		
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	45.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	6610	0.95	Level	3	0	0.985	1.00	7062
Ramp	250	0.92	Level	2	0	0.990	1.00	274
UpStream	710	0.92	Level	2	0	0.990	1.00	779
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R = mph (Exhibit 13-11)

S_0 = mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 using Equation (Exhibit 13-7)

V_{12} = 3234 pc/h

V_3 or V_{av34} 1914 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	7062	Exhibit 13-8	9600	No
$V_{FO} = V_F - V_R$	6788	Exhibit 13-8	9600	No
V_R	274	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3234	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 30.3 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

D_s = 0.323 (Exhibit 13-12)

S_R = 61.0 mph (Exhibit 13-12)

S_0 = 73.2 mph (Exhibit 13-12)

S = 67.1 mph (Exhibit 13-13)

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-95 NB*
Agency or Company	*AECOM*	From/To	*Seg 6-South of Off to 10th*
Date Performed		Jurisdiction	
Analysis Time Period	*AM*	Analysis Year	*2020 Build 2A*

Project Description *SW 10th Street SIMR*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6360*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1699*	pc/h/ln
S	*67.1*	mph
D = v_p / S	*25.3*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

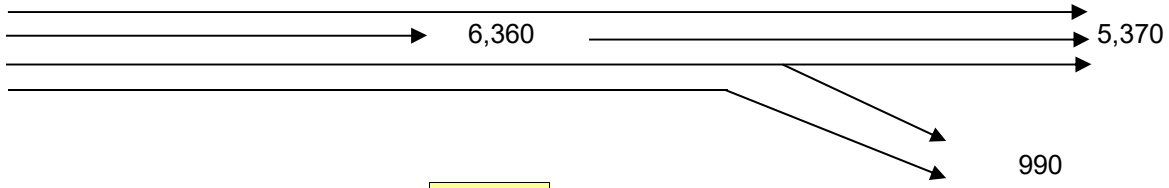
N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Job: SW 10th Street SIMR
Analyst: AECOM

Location: **Seg 7: I-95 NB Off-Ramp to SW 10th St EB & WB**
Analysis Period: **AM Peak Hour**
Analysis Year: **2020 Build 2A**



	PHF =	**0.95**	
	v_{fr} =	**6,360**	vph
	v_r =	**990**	vph
	v_f =	**5,370**	
Upstream Freeway	**Tr % =**	**3%**	
Ramp	**Tr % =**	**2%**	
Downstream Freeway	**Tr % =**	**3%**	
Freeway	**f_{HV} =**	$1/(1+P_T(E_T-1)+P_R(E_R-1))$ =	**0.985**
Ramp	**f_{HV} =**	$1/(1+P_T(E_T-1)+P_R(E_R-1))$ =	**0.9901**
flat terrain	**E_T =**	1.5	
	RV % =	0	
Driver Population adj.	**f_P =**	1.000	
	V_{fr} =	$=v_{fr}/(PHF)(f_{HV})(f_P)$ =	**6,795 pc/h**
	V_r =	$=v_r/(PHF)(f_{HV})(f_P)$ =	**1,053 pc/h**
	V_f =	$=v_f/(PHF)(f_{HV})(f_P)$ =	**5,737 pc/h**
No. lanes upstream of ramp	**N =**	**4**	

Average Freeway Density Upstream of Diverge (see Equation 13-26):

D = 0.0175 (V_{fr}/N) = 29.7 pc/ln

LOS in the Diverge Area (from Density and Exhibit 13-2) =

D

No. Ln	Capacity Check (see Exhibits 13-2, 13-8 and 13.10)	Maximum	Actual	LOS F?
4	Fwy upstream of ramp (assume 70 mph free-flow speed) =	9,600	6,795	No
3	Fwy downstream of ramp (assume 70 mph free-flow speed) =	7,200	5,737	No
2	Capacity on Off-Ramp (assume 45 mph free-flow speed) =	4,200	1,053	No

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-95 NB*
Agency or Company	*AECOM*	From/To	*Seg 8-Bet Off & Off Ramps*
Date Performed		Jurisdiction	
Analysis Time Period	*AM*	Analysis Year	*2020 Build 2A*

Project Description *SW 10th Street SIMR*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5370*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1912*	pc/h/ln
S	*64.1*	mph
D = v_p / S	*29.8*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-95 NB
Agency or Company	AECOM	Junction	Seg 9-Off to Hillsboro EB&WB
Date Performed		Jurisdiction	
Analysis Time Period	AM	Analysis Year	2020 Build 2A

Project Description SW 10th Street SIMR

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	3	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	1	☑ Yes	☑ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☐ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	200	L_{down} =	2100 ft
V_u =	veh/h	Freeway Volume, V_F	5370	V_D =	1290 veh/h
		Ramp Volume, V_R	1250		
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	45.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5370	0.95	Level	3	0	0.985	1.00	5737
Ramp	1250	0.92	Level	2	0	0.990	1.00	1372
UpStream								
DownStream	1290	0.92	Level	2	0	0.990	1.00	1416

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.553 using Equation (Exhibit 13-7)

V_{12} = 3788 pc/h

V_3 or V_{av34} 1949 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5737	Exhibit 13-8	7200	No
$V_{FO} = V_F - V_R$	4365	Exhibit 13-8	7200	No
V_R	1372	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3788	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 35.0 (pc/mi/ln)

LOS = E (Exhibit 13-2)

Speed Determination

D_s = 0.421 (Exhibit 13-12)

S_R= 58.2 mph (Exhibit 13-12)

S_0= 73.1 mph (Exhibit 13-12)

S = 62.5 mph (Exhibit 13-13)

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	
Agency or Company	*AECOM*
Date Performed	
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*I-95 NB*
From/To	*Seg 10-Bet Off & On Ramps*
Jurisdiction	
Analysis Year	*2020 Build 2A*

Project Description *SW 10th Street SIMR*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4120*	veh/h	Peak-Hour Factor, PHF	*0.95*	
AADT		veh/day	%Trucks and Buses, P_T	*3*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1467*	pc/h/ln
S	*69.2*	mph
D = v_p / S	*21.2*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

FREEWAY WEAVING WORKSHEET

General Information

Analyst	
Agency/Company	AECOM
Date Performed	
Analysis Time Period	AM

Site Information

Freeway/Dir of Travel	I-95 NB
Weaving Segment Location	Seg 11-Bet On & Off to Exp
Analysis Year	2020 Build 2A

Project Description SW 10th Street SIMR

Inputs

Weaving configuration	Two-Sided	Segment type	Freeway
Weaving number of lanes, N	4	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	2970ft	Freeway maximum capacity, C_{IFL}	2400
Freeway free-flow speed, FFS	70 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	3644	0.95	3	0	1.5	1.2	0.985	1.00	3893
V_{RF}	2246	0.92	2	0	1.5	1.2	0.990	1.00	2466
V_{FR}	476	0.92	2	0	1.5	1.2	0.990	1.00	523
V_{RR}	294	0.92	2	0	1.5	1.2	0.990	1.00	323
V_{NW}	6882							V =	7205
V_W	323								
VR	0.045								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	0 lc	Minimum weaving lane changes, LC_{MIN}	969 lc/h
Interchange density, ID	0.7 int/mi	Weaving lane changes, LC_W	1462 lc/h
Minimum RF lane changes, LC_{RF}	0 lc/pc	Non-weaving lane changes, LC_{NW}	2452 lc/h
Minimum FR lane changes, LC_{FR}	0 lc/pc	Total lane changes, LC_{ALL}	3914 lc/h
Minimum RR lane changes, LC_{RR}	3 lc/pc	Non-weaving vehicle index, I_{NW}	1431

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	7115 veh/h	Weaving intensity factor, W	0.281
Weaving segment capacity, c_w	8500 veh/h	Weaving segment speed, S	54.5 mph
Weaving segment v/c ratio	0.837	Average weaving speed, S_W	57.9 mph
Weaving segment density, D	33.0 pc/mi/ln	Average non-weaving speed, S_{NW}	54.4 mph
Level of Service, LOS	D	Maximum weaving length, L_{MAX}	6144 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	
Agency or Company	*AECOM*
Date Performed	
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*I-95 NB*
From/To	*Seg 12-North of Hillsboro*
Jurisdiction	
Analysis Year	*2020 Build 2A*

Project Description *SW 10th Street SIMR*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5890*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1573*	pc/h/ln
S	*68.4*	mph
D = v_p / S	*23.0*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

FREEWAY WEAVING WORKSHEET

General Information

Analyst	
Agency/Company	AECOM
Date Performed	
Analysis Time Period	PM

Site Information

Freeway/Dir of Travel	I-95 NB
Weaving Segment Location	Seg 1-Bet Copans & Sample
Analysis Year	2020 Build 2A

Project Description SW 10th Street SIMR

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	4	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	2380ft	Freeway maximum capacity, C_{IFL}	2400
Freeway free-flow speed, FFS	70 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	3985	0.95	3	0	1.5	1.2	0.985	1.00	4258
V_{RF}	415	0.92	2	0	1.5	1.2	0.990	1.00	456
V_{FR}	1560	0.92	2	0	1.5	1.2	0.990	1.00	1713
V_{RR}	0	0.95	0	0	1.5	1.2	1.000	1.00	0
V_{NW}	4258							V =	6427
V_W	2169								
VR	0.337								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	2169 lc/h
Interchange density, ID	0.7 int/mi	Weaving lane changes, LC_W	2604 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	1397 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	4001 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	709

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	6342 veh/h	Weaving intensity factor, W	0.340
Weaving segment capacity, c_w	7006 veh/h	Weaving segment speed, S	49.5 mph
Weaving segment v/c ratio	0.905	Average weaving speed, S_W	56.0 mph
Weaving segment density, D	32.5 pc/mi/ln	Average non-weaving speed, S_{NW}	46.7 mph
Level of Service, LOS	D	Maximum weaving length, L_{MAX}	5989 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-95 NB*
Agency or Company	*AECOM*	From/To	*Seg 2-Bet Off & On from Sample*
Date Performed		Jurisdiction	
Analysis Time Period	*PM*	Analysis Year	*2020 Build 2A*

Project Description *SW 10th Street SIMR*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4400*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1567*	pc/h/ln
S	*68.4*	mph
D = v_p / S	*22.9*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

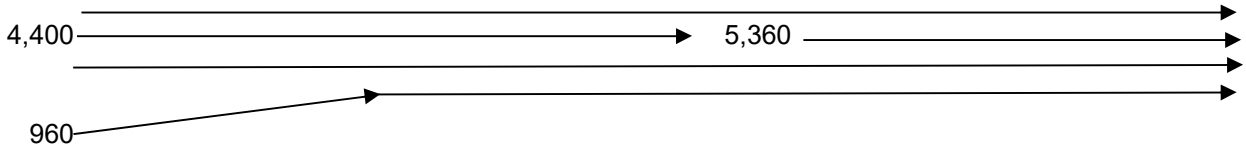
N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Job: SW 10th Street SIMR
Analyst: AECOM

Location: **Seg 3: I-95 Northbound On-Ramp from WB Sample Road**
Analysis Period: **PM Peak Hour**
Analysis Year: **2020 Build 2A**



	PHF =	**0.95**		
	v_{fr} =	**5,360**	vph	
	v_r =	**960**	vph	
	v_f =	**4,400**		
Upstream Freeway	**Tr % =**	**3%**		
Ramp	**Tr % =**	**2%**		
Downstream Freeway	**Tr % =**	**3%**		
Freeway	**f_{HV} =**	$1/(1+P_T(E_T-1)+P_R(E_R-1))$ =	**0.985**	
Ramp	**f_{HV} =**	$1/(1+P_T(E_T-1)+P_R(E_R-1))$ =	**0.9901**	
flat terrain	**E_T =**	1.5		
	RV % =	0		
Driver Population adj.	**f_P =**	1.000		
	V_{fr} =	$=v_{fr}/(PHF)(f_{HV})(f_P)$ =	**5,727**	**pc/h**
	V_r =	$=v_r/(PHF)(f_{HV})(f_P)$ =	**1,021**	**pc/h**
	V_f =	$=v_f/(PHF)(f_{HV})(f_P)$ =	**4,701**	**pc/h**
No. lanes upstream of ramp	**N =**	**3**		

No. Ln	Capacity Check (see Exhibits 25-3 and 25-7):	Maximum	Actual	V/c	LOS F?
4	Fwy downstream of ramp (assume 70 mph free-flow speed) =	9,600	5,727	0.60	No
3	Fwy upstream of ramp (assume 70 mph free-flow speed) =	7,200	4,701	0.65	No
1	Capacity on On-Ramp (assume 45 mph free-flow speed) =	2,100	1,021	0.49	No

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information

Analyst		Freeway/Dir of Travel	I-95 NB
Agency or Company	AECOM	Junction	Seg 4-On from Exp
Date Performed		Jurisdiction	
Analysis Time Period	PM	Analysis Year	2020 Build 2A

Project Description SW 10th Street SIMR

Site Information

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	4	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	1	☑ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A	1500	☐ No	☑ Off
L_{up} =	ft	Deceleration Lane Length L_D		L_{down} =	2950 ft
V_u =	veh/h	Freeway Volume, V_F	5360	V_D =	330 veh/h
		Ramp Volume, V_R	620		
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	50.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5360	0.95	Level	3	0	0.985	1.00	5727
Ramp	620	0.92	Level	2	0	0.990	1.00	681
UpStream								
DownStream	330	0.92	Level	2	0	0.990	1.00	362

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.133 using Equation (Exhibit 13-6)

V_{12} = 760 pc/h

V_3 or V_{av34} 2483 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes,V_{12a} = 2290 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	6408	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3245	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = 22.5 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.271 (Exibit 13-11)

S_R= 62.4 mph (Exhibit 13-11)

S_0= 66.4 mph (Exhibit 13-11)

S = 64.3 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-95 NB
Agency or Company	AECOM	Junction	Seg 5-Off to Exp from GPL
Date Performed		Jurisdiction	
Analysis Time Period	PM	Analysis Year	2020 Build 2A

Project Description SW 10th Street SIMR

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	4	Downstream Adj Ramp	
☑ Yes	☑ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☐ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	2950 ft	Deceleration Lane Length L_D	200	L_{down} =	ft
V_u =	620 veh/h	Freeway Volume, V_F	5980	V_D =	veh/h
		Ramp Volume, V_R	330		
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	45.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5980	0.95	Level	3	0	0.985	1.00	6389
Ramp	330	0.92	Level	2	0	0.990	1.00	362
UpStream	620	0.92	Level	2	0	0.990	1.00	681
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 using Equation (Exhibit 13-7)

V_{12} = 2990 pc/h

V_3 or V_{av34} 1699 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	6389	Exhibit 13-8	9600	No
$V_{FO} = V_F - V_R$	6027	Exhibit 13-8	9600	No
V_R	362	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2990	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 28.2 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

D_s = 0.331 (Exhibit 13-12)

S_R= 60.7 mph (Exhibit 13-12)

S_0= 74.1 mph (Exhibit 13-12)

S = 67.2 mph (Exhibit 13-13)

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-95 NB*
Agency or Company	*AECOM*	From/To	*Seg 6-South of Off to 10th*
Date Performed		Jurisdiction	
Analysis Time Period	*PM*	Analysis Year	*2020 Build 2A*

Project Description *SW 10th Street SIMR*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5650*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1509*	pc/h/ln
S	*68.9*	mph
D = v_p / S	*21.9*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

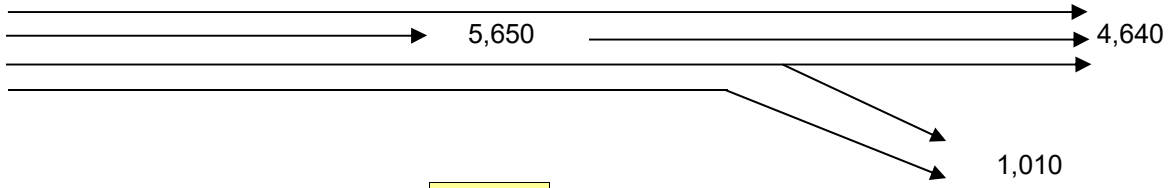
N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Job: SW 10th Street SIMR
Analyst: AECOM

Location: Seg 7: I-95 NB Off-Ramp to SW 10th St EB & WB
Analysis Period: PM Peak Hour
Analysis Year: 2020 Build 2A



	PHF =	0.95		
	v_{fr} =	5,650	vph	
	v_r =	1,010	vph	
	v_f =	4,640		
Upstream Freeway	Tr % =	3%		
Ramp	Tr % =	2%		
Downstream Freeway	Tr % =	3%		
Freeway	f_{HV} =	$1/(1+P_T(E_T-1)+P_R(E_R-1))$ =		0.985
Ramp	f_{HV} =	$1/(1+P_T(E_T-1)+P_R(E_R-1))$ =		0.9901
flat terrain	E_T =	1.5		
	RV % =	0		
Driver Population adj.	f_P =	1.000		
	V_{fr} =	$=v_{fr}/(PHF)(f_{HV})(f_P)$ =	6,037	pc/h
	V_r =	$=v_r/(PHF)(f_{HV})(f_P)$ =	1,074	pc/h
	V_f =	$=v_f/(PHF)(f_{HV})(f_P)$ =	4,957	pc/h
No. lanes upstream of ramp	N =	4		

Average Freeway Density Upstream of Diverge (see Equation 13-26):

D = 0.0175 (V_{fr}/N) = 26.4 pc/ln

LOS in the Diverge Area (from Density and Exhibit 13-2) = C

No. Ln	Capacity Check (see Exhibits 13-2, 13-8 and 13.10)	Maximum	Actual	LOS F?
4	Fwy upstream of ramp (assume 70 mph free-flow speed) =	9,600	6,037	No
3	Fwy downstream of ramp (assume 70 mph free-flow speed) =	7,200	4,957	No
1	Capacity on Off-Ramp (assume 45 mph free-flow speed) =	2,100	1,074	No

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	
Agency or Company	*AECOM*
Date Performed	
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*I-95 NB*
From/To	*Seg 8-Bet Off & Off Ramps*
Jurisdiction	
Analysis Year	*2020 Build 2A*

Project Description *SW 10th Street SIMR*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4640*	veh/h	Peak-Hour Factor, PHF	*0.95*	
AADT		veh/day	%Trucks and Buses, P_T	*3*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1652*	pc/h/ln
S	*67.6*	mph
D = v_p / S	*24.4*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-95 NB
Agency or Company	AECOM	Junction	Seg 9-Off to Hillsboro EB&WB
Date Performed		Jurisdiction	
Analysis Time Period	PM	Analysis Year	2020 Build 2A

Project Description SW 10th Street SIMR

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	3	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	1	☑ Yes	☑ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☐ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	200	L_{down} =	2100 ft
V_u =	veh/h	Freeway Volume, V_F	4640	V_D =	1560 veh/h
		Ramp Volume, V_R	1230		
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	45.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4640	0.95	Level	3	0	0.985	1.00	4957
Ramp	1230	0.92	Level	2	0	0.990	1.00	1350
UpStream								
DownStream	1560	0.92	Level	2	0	0.990	1.00	1713

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R = mph (Exhibit 13-11)

S_0 = mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.574 using Equation (Exhibit 13-7)

V_{12} = 3420 pc/h

V_3 or V_{av34} 1537 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4957	Exhibit 13-8	7200	No
$V_{FO} = V_F - V_R$	3607	Exhibit 13-8	7200	No
V_R	1350	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3420	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 31.9 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

D_s = 0.419 (Exhibit 13-12)

S_R = 58.3 mph (Exhibit 13-12)

S_0 = 74.7 mph (Exhibit 13-12)

S = 62.5 mph (Exhibit 13-13)

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	
Agency or Company	*AECOM*
Date Performed	
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*I-95 NB*
From/To	*Seg 10-Bet Off & On Ramps*
Jurisdiction	
Analysis Year	*2020 Build 2A*

Project Description *SW 10th Street SIMR*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3410*	veh/h	Peak-Hour Factor, PHF	*0.95*	
AADT		veh/day	%Trucks and Buses, P_T	*3*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1214*	pc/h/ln
S	*70.0*	mph
D = v_p / S	*17.3*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

FREEWAY WEAVING WORKSHEET

General Information

Analyst	
Agency/Company	AECOM
Date Performed	
Analysis Time Period	PM

Site Information

Freeway/Dir of Travel	I-95 NB
Weaving Segment Location	Seg 11-Bet On & Off to Exp
Analysis Year	2020 Build 2A

Project Description SW 10th Street SIMR

Inputs

Weaving configuration	Two-Sided	Segment type	Freeway
Weaving number of lanes, N	4	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	2970ft	Freeway maximum capacity, C_{IFL}	2400
Freeway free-flow speed, FFS	70 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	2904	0.95	3	0	1.5	1.2	0.985	1.00	3103
V_{RF}	2376	0.92	2	0	1.5	1.2	0.990	1.00	2608
V_{FR}	506	0.92	2	0	1.5	1.2	0.990	1.00	556
V_{RR}	414	0.92	2	0	1.5	1.2	0.990	1.00	455
V_{NW}	6267							V =	6722
V_W	455								
VR	0.068								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	0 lc	Minimum weaving lane changes, LC_{MIN}	1365 lc/h
Interchange density, ID	0.7 int/mi	Weaving lane changes, LC_W	1858 lc/h
Minimum RF lane changes, LC_{RF}	0 lc/pc	Non-weaving lane changes, LC_{NW}	2135 lc/h
Minimum FR lane changes, LC_{FR}	0 lc/pc	Total lane changes, LC_{ALL}	3993 lc/h
Minimum RR lane changes, LC_{RR}	3 lc/pc	Non-weaving vehicle index, I_{NW}	1303

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	6640 veh/h	Weaving intensity factor, W	0.285
Weaving segment capacity, c_w	8437 veh/h	Weaving segment speed, S	52.5 mph
Weaving segment v/c ratio	0.787	Average weaving speed, S_W	57.8 mph
Weaving segment density, D	32.0 pc/mi/ln	Average non-weaving speed, S_{NW}	52.1 mph
Level of Service, LOS	D	Maximum weaving length, L_{MAX}	6361 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	
Agency or Company	*AECOM*
Date Performed	
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*I-95 NB*
From/To	*Seg 12-North of Hillsboro*
Jurisdiction	
Analysis Year	*2020 Build 2A*

Project Description *SW 10th Street SIMR*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5280*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1410*	pc/h/ln
S	*69.5*	mph
D = v_p / S	*20.3*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	
Agency or Company	*AECOM*
Date Performed	
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*I-95 SB*
From/To	*Seg 1-Bet Hillsboro & Palmetto*
Jurisdiction	
Analysis Year	*2020 Build 2A*

Project Description *SW 10th Street SIMR*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4560*	veh/h	Peak-Hour Factor, PHF	*0.95*	
AADT		veh/day	%Trucks and Buses, P_T	*3*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1218*	pc/h/ln
S	*70.0*	mph
D = v_p / S	*17.4*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

FREEWAY WEAVING WORKSHEET

General Information

Analyst	
Agency/Company	AECOM
Date Performed	
Analysis Time Period	AM

Site Information

Freeway/Dir of Travel	I95/SB
Weaving Segment Location	Seg 2-Bet On from Exp & Off
Analysis Year	2020 Build 2A

Project Description SW 10th Street SIMR

Inputs

Weaving configuration	Two-Sided	Segment type	Freeway
Weaving number of lanes, N	4	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	3900ft	Freeway maximum capacity, C_{IFL}	2400
Freeway free-flow speed, FFS	70 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	3470	0.95	3	0	1.5	1.2	0.985	1.00	3707
V_{RF}	970	0.92	2	0	1.5	1.2	0.990	1.00	1065
V_{FR}	1090	0.92	2	0	1.5	1.2	0.990	1.00	1197
V_{RR}	110	0.92	2	0	1.5	1.2	0.990	1.00	121
V_{NW}	5969							V =	6090
V_W	121								
VR	0.020								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	0 lc	Minimum weaving lane changes, LC_{MIN}	363 lc/h
Interchange density, ID	0.7 int/mi	Weaving lane changes, LC_W	935 lc/h
Minimum RF lane changes, LC_{RF}	0 lc/pc	Non-weaving lane changes, LC_{NW}	2800 lc/h
Minimum FR lane changes, LC_{FR}	0 lc/pc	Total lane changes, LC_{ALL}	3735 lc/h
Minimum RR lane changes, LC_{RR}	3 lc/pc	Non-weaving vehicle index, I_{NW}	1630

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	6012 veh/h	Weaving intensity factor, W	0.218
Weaving segment capacity, c_w	8851 veh/h	Weaving segment speed, S	60.1 mph
Weaving segment v/c ratio	0.679	Average weaving speed, S_W	60.1 mph
Weaving segment density, D	25.3 pc/mi/ln	Average non-weaving speed, S_{NW}	60.1 mph
Level of Service, LOS	C	Maximum weaving length, L_{MAX}	5911 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	
Agency or Company	*AECOM*
Date Performed	
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*I-95 SB*
From/To	*Seg 3-Bet Off & On Ramp*
Jurisdiction	
Analysis Year	*2020 Build 2A*

Project Description *SW 10th Street SIMR*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4440*	veh/h	Peak-Hour Factor, PHF	*0.95*	
AADT		veh/day	%Trucks and Buses, P_T	*3*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1581*	pc/h/ln
S	*68.3*	mph
D = v_p / S	*23.1*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-95 SB
Agency or Company	AECOM	Junction	Seg 4-Diverge to SW 10th St
Date Performed		Jurisdiction	
Analysis Time Period	AM	Analysis Year	2020 Build 2A

Project Description SW 10th Street SIMR

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	3	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	1	☑ Yes	☑ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☐ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	200	L_{down} =	2400 ft
V_u =	veh/h	Freeway Volume, V_F	4440	V_D =	1310 veh/h
		Ramp Volume, V_R	1440		
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	45.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4440	0.95	Level	3	0	0.985	1.00	4744
Ramp	1440	0.92	Level	2	0	0.990	1.00	1581
UpStream								
DownStream	1310	0.92	Level	2	0	0.990	1.00	1438

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R = mph (Exhibit 13-11)

S_0 = mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.569 using Equation (Exhibit 13-7)

V_{12} = 3380 pc/h

V_3 or V_{av34} 1364 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4744	Exhibit 13-8	7200	No
$V_{FO} = V_F - V_R$	3163	Exhibit 13-8	7200	No
V_R	1581	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3380	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 31.5 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

D_s = 0.440 (Exhibit 13-12)

S_R = 57.7 mph (Exhibit 13-12)

S_0 = 75.4 mph (Exhibit 13-12)

S = 61.8 mph (Exhibit 13-13)

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	
Agency or Company	*AECOM*
Date Performed	
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*I-95 SB*
From/To	*Seg 5-Bet Off & On Ramps*
Jurisdiction	
Analysis Year	*2020 Build 2A*

Project Description *SW 10th Street SIMR*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3000*	veh/h	Peak-Hour Factor, PHF	*0.95*	
AADT		veh/day	%Trucks and Buses, P_T	*3*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1068*	pc/h/ln
S	*70.0*	mph
D = v_p / S	*15.3*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-95 SB
Agency or Company	AECOM	Junction	Seg 6-Merge from Hillsboro E&W
Date Performed		Jurisdiction	
Analysis Time Period	AM	Analysis Year	2020 Build 2A

Project Description SW 10th Street SIMR

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	3	Downstream Adj Ramp	
☑ Yes	☐ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☐ No	☑ Off	Acceleration Lane Length, L_A	300	☑ No	☐ Off
L_{up} =	2400 ft	Deceleration Lane Length L_D		L_{down} =	ft
V_u =	1440 veh/h	Freeway Volume, V_F	3000	V_D =	veh/h
		Ramp Volume, V_R	1310		
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	50.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3000	0.95	Level	3	0	0.985	1.00	3205
Ramp	1310	0.92	Level	2	0	0.990	1.00	1438
UpStream	1440	0.92	Level	2	0	0.990	1.00	1581
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = 1339.80 (Equation 13-6 or 13-7)

P_{FM} = 0.586 using Equation (Exhibit 13-6)

V_{12} = 1878 pc/h

V_3 or V_{av34} 1327 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes,V_{12a} = 1878 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4643	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3316	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 28.8 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

M_S = 0.398 (Exibit 13-11)

S_R= 58.8 mph (Exhibit 13-11)

S_0= 67.0 mph (Exhibit 13-11)

S = 61.0 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	
Agency or Company	*AECOM*
Date Performed	
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*I-95 SB*
From/To	*Seg 7-Bet On Ramps*
Jurisdiction	
Analysis Year	*2020 Build 2A*

Project Description *SW 10th Street SIMR*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4310*	veh/h	Peak-Hour Factor, PHF	*0.95*	
AADT		veh/day	%Trucks and Buses, P_T	*3*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1535*	pc/h/ln
S	*68.7*	mph
D = v_p / S	*22.3*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

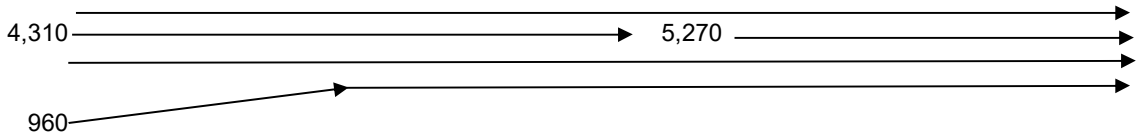
N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Job: SW 10th Street SIMR
Analyst: AECOM

Location: **Seg 8: I-95 Southbound On-Ramp from SW 10th Street EB & WB**
Analysis Period: **AM Peak Hour**
Analysis Year: **2020 Build 2A**



	PHF =	**0.95**		
	v_{fr} =	**5,270**	vph	
	v_r =	**960**	vph	
	v_f =	**4,310**		
Upstream Freeway	**Tr % =**	**3%**		
Ramp	**Tr % =**	**2%**		
Downstream Freeway	**Tr % =**	**3%**		
Freeway	**f_{HV} =**	$1/(1+P_T(E_T-1)+P_R(E_R-1))$ =	**0.985**	
Ramp	**f_{HV} =**	$1/(1+P_T(E_T-1)+P_R(E_R-1))$ =	**0.9901**	
flat terrain	**E_T =**	1.5		
	RV % =	0		
Driver Population adj.	**f_P =**	1.000		
	V_{fr} =	$=v_{fr}/(PHF)(f_{HV})(f_P)$ =	**5,631**	**pc/h**
	V_r =	$=v_r/(PHF)(f_{HV})(f_P)$ =	**1,021**	**pc/h**
	V_f =	$=v_f/(PHF)(f_{HV})(f_P)$ =	**4,605**	**pc/h**
No. lanes upstream of ramp	**N =**	**3**		

No. Ln	**Capacity Check (see Exhibits 25-3 and 25-7):**	Maximum	Actual	V/c	LOS F?
4	Fwy downstream of ramp (assume 70 mph free-flow speed) =	9,600	5,631	0.59	No
3	Fwy upstream of ramp (assume 70 mph free-flow speed) =	7,200	4,605	0.64	No
1	Capacity on On-Ramp (assume 45 mph free-flow speed) =	2,100	1,021	0.49	No

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-95 SB*
Agency or Company	*AECOM*	From/To	*Seg 9-Bet 10th & Exit to Exp*
Date Performed		Jurisdiction	
Analysis Time Period	*AM*	Analysis Year	*2020 Build 2A*

Project Description *SW 10th Street SIMR*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5270*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
			Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1408*	pc/h/ln
S	*69.5*	mph
D = v_p / S	*20.3*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-95 SB
Agency or Company	AECOM	Junction	Seg 10-Merge from Ex to GP
Date Performed		Jurisdiction	
Analysis Time Period	AM	Analysis Year	2020 Build 2A

Project Description SW 10th Street SIMR

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	4	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	1	☑ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A	600	☐ No	☑ Off
L_{up} =	ft	Deceleration Lane Length L_D		L_{down} =	1150 ft
V_u =	veh/h	Freeway Volume, V_F	5270	V_D =	620 veh/h
		Ramp Volume, V_R	320		
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	50.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5270	0.95	Level	3	0	0.985	1.00	5631
Ramp	320	0.92	Level	2	0	0.990	1.00	351
UpStream								
DownStream	620	0.92	Level	2	0	0.990	1.00	681

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.174 using Equation (Exhibit 13-6)

V_{12} = 979 pc/h

V_3 or V_{av34} 2326 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes,V_{12a} = 2252 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	5982	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2603	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = 21.9 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.314 (Exibit 13-11)

S_R= 61.2 mph (Exhibit 13-11)

S_0= 65.7 mph (Exhibit 13-11)

S = 63.7 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-95 SB
Agency or Company	AECOM	Junction	Seg 11- Diverge to Express
Date Performed		Jurisdiction	
Analysis Time Period	AM	Analysis Year	2020 Build 2A

Project Description SW 10th Street SIMR

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	4	Downstream Adj Ramp	
☑ Yes	☑ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☐ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	1150 ft	Deceleration Lane Length L_D	200	L_{down} =	ft
V_u =	320 veh/h	Freeway Volume, V_F	5590	V_D =	veh/h
		Ramp Volume, V_R	620		
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	45.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5590	0.95	Level	3	0	0.985	1.00	5972
Ramp	620	0.92	Level	2	0	0.990	1.00	681
UpStream	320	0.92	Level	2	0	0.990	1.00	351
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 using Equation (Exhibit 13-7)

V_{12} = 2988 pc/h

V_3 or V_{av34} 1492 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5972	Exhibit 13-8	9600	No
$V_{FO} = V_F - V_R$	5291	Exhibit 13-8	9600	No
V_R	681	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2988	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 30.7 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

D_s = 0.359 (Exhibit 13-12)

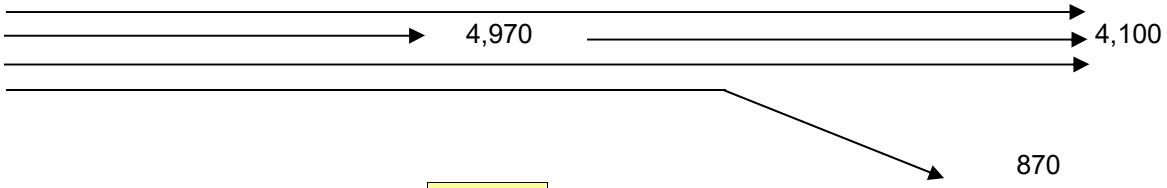
S_R= 59.9 mph (Exhibit 13-12)

S_0= 75.5 mph (Exhibit 13-12)

S = 66.0 mph (Exhibit 13-13)

Job: SW 10th Street SIMR
Analyst: AECOM

Location: **Seg 12: I-95 SB Off-Ramp to Sample Road EB & WB**
Analysis Period: **AM Peak Hour**
Analysis Year: **2020 Build 2A**



	PHF =	**0.95**		
	v_{fr} =	**4,970**	vph	
	v_r =	**870**	vph	
	v_f =	**4,100**		
Upstream Freeway	**Tr % =**	**3%**		
Ramp	**Tr % =**	**2%**		
Downstream Freeway	**Tr % =**	**3%**		
Freeway	**f_{HV} =**	$1/(1+P_T(E_T-1)+P_R(E_R-1))$ =		**0.985**
Ramp	**f_{HV} =**	$1/(1+P_T(E_T-1)+P_R(E_R-1))$ =		**0.9901**
flat terrain	**E_T =**	1.5		
	RV % =	0		
Driver Population adj.	**f_P =**	1.000		
	V_{fr} =	$=v_{fr}/(PHF)(f_{HV})(f_P)$ =	**5,310**	**pc/h**
	V_r =	$=v_r/(PHF)(f_{HV})(f_P)$ =	**925**	**pc/h**
	V_f =	$=v_f/(PHF)(f_{HV})(f_P)$ =	**4,381**	**pc/h**
No. lanes upstream of ramp	**N =**	**4**		

Average Freeway Density Upstream of Diverge (see Equation 13-26):

D = 0.0175 (V_{fr}/N) = 23.2 pc/ln

LOS in the Diverge Area (from Density and Exhibit 13-2) =

C

No. Ln	Capacity Check (see Exhibits 13-2, 13-8 and 13.10)	Maximum	Actual	LOS F?
4	Fwy upstream of ramp (assume 70 mph free-flow speed) =	9,600	5,310	No
3	Fwy downstream of ramp (assume 70 mph free-flow speed) =	7,200	4,381	No
1	Capacity on Off-Ramp (assume 45 mph free-flow speed) =	2,100	925	No

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	
Agency or Company	*AECOM*
Date Performed	
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*I-95 SB*
From/To	*Seg 13-Bet Off & On Ramps*
Jurisdiction	
Analysis Year	*2020 Build 2A*

Project Description *SW 10th Street SIMR*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4100*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1460*	pc/h/ln
S	*69.2*	mph
D = v_p / S	*21.1*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

FREEWAY WEAVING WORKSHEET

General Information

Analyst	
Agency/Company	AECOM
Date Performed	
Analysis Time Period	AM

Site Information

Freeway/Dir of Travel	I-95 SB
Weaving Segment Location	Seg 14- Bet Sample & Copans
Analysis Year	2020 Build 2A

Project Description SW 10th Street SIMR

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	4	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	2520ft	Freeway maximum capacity, C_{IFL}	2400
Freeway free-flow speed, FFS	70 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	3485	0.95	3	0	1.5	1.2	0.985	1.00	3723
V_{RF}	1770	0.92	2	0	1.5	1.2	0.990	1.00	1943
V_{FR}	615	0.92	2	0	1.5	1.2	0.990	1.00	675
V_{RR}	0	0.95	0	0	1.5	1.2	1.000	1.00	0
V_{NW}	3723							V =	6341
V_W	2618								
VR	0.413								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	lc/h
Interchange density, ID	0.7 int/mi	Weaving lane changes, LC_W	lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	6261 veh/h	Weaving intensity factor, W	
Weaving segment capacity, c_w	5727 veh/h	Weaving segment speed, S	mph
Weaving segment v/c ratio	1.093	Average weaving speed, S_W	mph
Weaving segment density, D	pc/mi/ln	Average non-weaving speed, S_{NW}	mph
Level of Service, LOS	F	Maximum weaving length, L_{MAX}	6826 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-95 SB*
Agency or Company	*AECOM*	From/To	*Seg 1-Bet Hillsboro & Palmetto*
Date Performed		Jurisdiction	
Analysis Time Period	*PM*	Analysis Year	*2020 Build 2A*

Project Description *SW 10th Street SIMR*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4530*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1210*	pc/h/ln
S	*70.0*	mph
D = v_p / S	*17.3*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 10-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

FREEWAY WEAVING WORKSHEET

General Information

Analyst	
Agency/Company	AECOM
Date Performed	
Analysis Time Period	PM

Site Information

Freeway/Dir of Travel	I95/SB
Weaving Segment Location	Seg 2-Bet On from Exp & Off
Analysis Year	2020 Build 2A

Project Description SW 10th Street SIMR

Inputs

Weaving configuration	Two-Sided	Segment type	Freeway
Weaving number of lanes, N	4	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	3900ft	Freeway maximum capacity, C_{IFL}	2400
Freeway free-flow speed, FFS	70 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	3600	0.95	3	0	1.5	1.2	0.985	1.00	3846
V_{RF}	970	0.92	2	0	1.5	1.2	0.990	1.00	1065
V_{FR}	930	0.92	2	0	1.5	1.2	0.990	1.00	1021
V_{RR}	110	0.92	2	0	1.5	1.2	0.990	1.00	121
V_{NW}	5932							V =	6053
V_W	121								
VR	0.020								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	0 lc	Minimum weaving lane changes, LC_{MIN}	363 lc/h
Interchange density, ID	0.7 int/mi	Weaving lane changes, LC_W	935 lc/h
Minimum RF lane changes, LC_{RF}	0 lc/pc	Non-weaving lane changes, LC_{NW}	2785 lc/h
Minimum FR lane changes, LC_{FR}	0 lc/pc	Total lane changes, LC_{ALL}	3720 lc/h
Minimum RR lane changes, LC_{RR}	3 lc/pc	Non-weaving vehicle index, I_{NW}	1619

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	5975 veh/h	Weaving intensity factor, W	0.218
Weaving segment capacity, c_w	8851 veh/h	Weaving segment speed, S	60.1 mph
Weaving segment v/c ratio	0.675	Average weaving speed, S_W	60.2 mph
Weaving segment density, D	25.2 pc/mi/ln	Average non-weaving speed, S_{NW}	60.1 mph
Level of Service, LOS	C	Maximum weaving length, L_{MAX}	5912 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	
Agency or Company	*AECOM*
Date Performed	
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*I-95 SB*
From/To	*Seg 3-Bet Off & On Ramp*
Jurisdiction	
Analysis Year	*2020 Build 2A*

Project Description *SW 10th Street SIMR*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4570*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1628*	pc/h/ln
S	*67.9*	mph
D = v_p / S	*24.0*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-95 SB
Agency or Company	AECOM	Junction	Seg 4-Diverge to SW 10th St
Date Performed		Jurisdiction	
Analysis Time Period	PM	Analysis Year	2020 Build 2A

Project Description SW 10th Street SIMR

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	3	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	1	☑ Yes	☑ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☐ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	200	L_{down} =	2400 ft
V_u =	veh/h	Freeway Volume, V_F	4570	V_D =	1470 veh/h
		Ramp Volume, V_R	1210		
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	45.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4570	0.95	Level	3	0	0.985	1.00	4883
Ramp	1210	0.92	Level	2	0	0.990	1.00	1328
UpStream								
DownStream	1470	0.92	Level	2	0	0.990	1.00	1614

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.577 using Equation (Exhibit 13-7)

V_{12} = 3379 pc/h

V_3 or V_{av34} 1504 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4883	Exhibit 13-8	7200	No
$V_{FO} = V_F - V_R$	3555	Exhibit 13-8	7200	No
V_R	1328	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3379	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 31.5 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

D_s = 0.418 (Exhibit 13-12)

S_R= 58.3 mph (Exhibit 13-12)

S_0= 74.8 mph (Exhibit 13-12)

S = 62.6 mph (Exhibit 13-13)

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	
Agency or Company	*AECOM*
Date Performed	
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*I-95 SB*
From/To	*Seg 5-Bet Off & On Ramps*
Jurisdiction	
Analysis Year	*2020 Build 2A*

Project Description *SW 10th Street SIMR*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3360*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1197*	pc/h/ln
S	*70.0*	mph
D = v_p / S	*17.1*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information

Analyst		Freeway/Dir of Travel	I-95 SB
Agency or Company	AECOM	Junction	Seg 6-Merge from Hillsboro E&W
Date Performed		Jurisdiction	
Analysis Time Period	PM	Analysis Year	2020 Build 2A

Project Description SW 10th Street SIMR

Site Information

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	3	Downstream Adj Ramp	
☑ Yes	☐ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☐ No	☑ Off	Acceleration Lane Length, L_A	300	☑ No	☐ Off
L_{up} =	2400 ft	Deceleration Lane Length L_D		L_{down} =	ft
V_u =	1210 veh/h	Freeway Volume, V_F	3360	V_D =	veh/h
		Ramp Volume, V_R	1470		
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	50.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3360	0.95	Level	3	0	0.985	1.00	3590
Ramp	1470	0.92	Level	2	0	0.990	1.00	1614
UpStream	1210	0.92	Level	2	0	0.990	1.00	1328
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = 1459.86 (Equation 13-6 or 13-7)

P_{FM} = 0.586 using Equation (Exhibit 13-6)

V_{12} = 2103 pc/h

V_3 or V_{av34} 1487 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes,V_{12a} = 2103 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	5204	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3717	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 31.8 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

M_S = 0.451 (Exibit 13-11)

S_R= 57.4 mph (Exhibit 13-11)

S_0= 66.4 mph (Exhibit 13-11)

S = 59.7 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	
Agency or Company	*AECOM*
Date Performed	
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*I-95 SB*
From/To	*Seg 7-Bet On Ramps*
Jurisdiction	
Analysis Year	*2020 Build 2A*

Project Description *SW 10th Street SIMR*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4830*	veh/h	Peak-Hour Factor, PHF	*0.95*	
AADT		veh/day	%Trucks and Buses, P_T	*3*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1720*	pc/h/ln
S	*66.9*	mph
D = v_p / S	*25.7*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

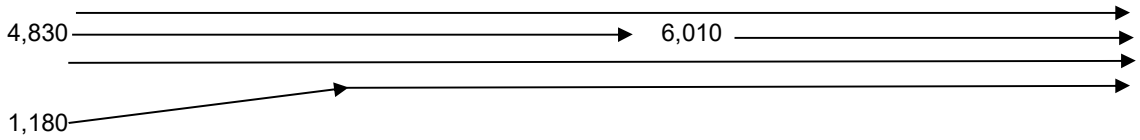
N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Job: SW 10th Street SIMR
Analyst: AECOM

Location: **Seg 8: I-95 Southbound On-Ramp from SW 10th Street EB & WB**
Analysis Period: **PM Peak Hour**
Analysis Year: **2020 Build 3**



	PHF =	0.95		
	v_{fr} =	6,010	vph	
	v_r =	1,180	vph	
	v_f =	4,830		
Upstream Freeway	Tr % =	3%		
Ramp	Tr % =	2%		
Downstream Freeway	Tr % =	3%		
Freeway	f_{HV} =	$1/(1+P_T(E_T-1)+P_R(E_R-1))$ =	0.985	
Ramp	f_{HV} =	$1/(1+P_T(E_T-1)+P_R(E_R-1))$ =	0.9901	
flat terrain	E_T =	1.5		
	RV % =	0		
Driver Population adj.	f_P =	1.000		
	V_{fr} =	$=v_{fr}/(PHF)(f_{HV})(f_P)$ =	6,421	pc/h
	V_r =	$=v_r/(PHF)(f_{HV})(f_P)$ =	1,255	pc/h
	V_f =	$=v_f/(PHF)(f_{HV})(f_P)$ =	5,160	pc/h
No. lanes upstream of ramp	N =	3		

No. Ln	Capacity Check (see Exhibits 25-3 and 25-7):	Maximum	Actual	V/c	LOS F?
4	Fwy downstream of ramp (assume 70 mph free-flow speed) =	9,600	6,421	0.67	No
3	Fwy upstream of ramp (assume 70 mph free-flow speed) =	7,200	5,160	0.72	No
1	Capacity on On-Ramp (assume 45 mph free-flow speed) =	2,100	1,255	0.60	No

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-95 SB*
Agency or Company	*AECOM*	From/To	*Seg 9-Bet 10th & Exit to Exp*
Date Performed		Jurisdiction	
Analysis Time Period	*PM*	Analysis Year	*2020 Build 2A*

Project Description *SW 10th Street SIMR*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6010*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
			Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1605*	pc/h/ln
S	*68.1*	mph
D = v_p / S	*23.6*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
S	mph
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information

Analyst		Freeway/Dir of Travel	I-95 SB
Agency or Company	AECOM	Junction	Seg 10-Merge from Ex to GP
Date Performed		Jurisdiction	
Analysis Time Period	PM	Analysis Year	2020 Build 2A

Project Description SW 10th Street SIMR

Site Information

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Freeway Number of Lanes, N	4
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	600
Deceleration Lane Length L_D	
Freeway Volume, V_F	6010
Ramp Volume, V_R	300
Freeway Free-Flow Speed, S_{FF}	70.0
Ramp Free-Flow Speed, S_{FR}	50.0

Downstream Adj Ramp

☑ Yes ☐ On

☐ No ☑ Off

L_{down} = 1150 ft

V_D = 670 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	6010	0.95	Level	3	0	0.985	1.00	6421
Ramp	300	0.92	Level	2	0	0.990	1.00	329
UpStream								
DownStream	670	0.92	Level	2	0	0.990	1.00	736

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.177 using Equation (Exhibit 13-6)

V_{12} = 1134 pc/h

V_3 or V_{av34} 2643 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes,V_{12a} = 2568 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	6750	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2897	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 24.2 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.332 (Exibit 13-11)

S_R= 60.7 mph (Exhibit 13-11)

S_0= 64.9 mph (Exhibit 13-11)

S = 63.0 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information

Analyst		Freeway/Dir of Travel	I-95 SB
Agency or Company	AECOM	Junction	Seg 11- Diverge to Express
Date Performed		Jurisdiction	
Analysis Time Period	PM	Analysis Year	2020 Build 2A

Project Description SW 10th Street SIMR

Site Information

Inputs

Upstream Adj Ramp

☑ Yes ☑ On

☐ No ☐ Off

L_{up} = 1150 ft

V_u = 300 veh/h

Freeway Number of Lanes, N	4
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	200
Freeway Volume, V_F	6310
Ramp Volume, V_R	670
Freeway Free-Flow Speed, S_{FF}	70.0
Ramp Free-Flow Speed, S_{FR}	45.0

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	6310	0.95	Level	3	0	0.985	1.00	6742
Ramp	670	0.92	Level	2	0	0.990	1.00	736
UpStream	300	0.92	Level	2	0	0.990	1.00	329
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 using Equation (Exhibit 13-7)

V_{12} = 3355 pc/h

V_3 or V_{av34} 1693 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	6742	Exhibit 13-8	9600	No
$V_{FO} = V_F - V_R$	6006	Exhibit 13-8	9600	No
V_R	736	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3355	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 34.2 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

D_s = 0.364 (Exhibit 13-12)

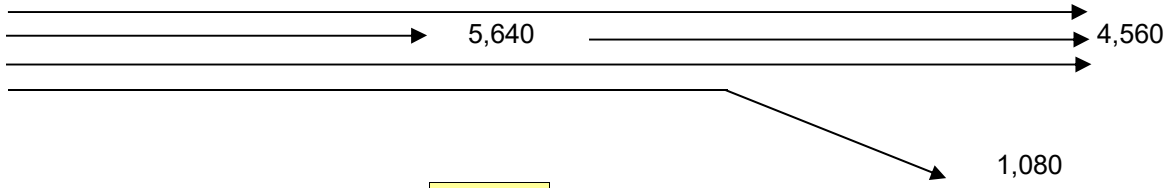
S_R= 59.8 mph (Exhibit 13-12)

S_0= 74.7 mph (Exhibit 13-12)

S = 65.7 mph (Exhibit 13-13)

Job: SW 10th Street SIMR
Analyst: AECOM

Location: **Seg 12: I-95 SB Off-Ramp to Sample Road EB & WB**
Analysis Period: **PM Peak Hour**
Analysis Year: **2020 Build 2A**



	PHF =	**0.95**	
	v_{fr} =	**5,640**	vph
	v_r =	**1,080**	vph
	v_f =	**4,560**	
Upstream Freeway	**Tr % =**	**3%**	
Ramp	**Tr % =**	**2%**	
Downstream Freeway	**Tr % =**	**3%**	
Freeway	**f_{HV} =**	$1/(1+P_T(E_T-1)+P_R(E_R-1))$ =	**0.985**
Ramp	**f_{HV} =**	$1/(1+P_T(E_T-1)+P_R(E_R-1))$ =	**0.9901**
flat terrain	**E_T =**	1.5	
	RV % =	0	
Driver Population adj.	**f_P =**	1.000	
	V_{fr} =	$=v_{fr}/(PHF)(f_{HV})(f_P)$ =	**6,026 pc/h**
	V_r =	$=v_r/(PHF)(f_{HV})(f_P)$ =	**1,148 pc/h**
	V_f =	$=v_f/(PHF)(f_{HV})(f_P)$ =	**4,872 pc/h**
No. lanes upstream of ramp	**N =**	**4**	

Average Freeway Density Upstream of Diverge (see Equation 13-26):

D = 0.0175 (V_{fr}/N) = 26.4 pc/ln

LOS in the Diverge Area (from Density and Exhibit 13-2) =

C

No. Ln	Capacity Check (see Exhibits 13-2, 13-8 and 13.10)	Maximum	Actual	LOS F?
4	Fwy upstream of ramp (assume 70 mph free-flow speed) =	9,600	6,026	No
3	Fwy downstream of ramp (assume 70 mph free-flow speed) =	7,200	4,872	No
1	Capacity on Off-Ramp (assume 45 mph free-flow speed) =	2,100	1,148	No

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	
Agency or Company	*AECOM*
Date Performed	
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*I-95 SB*
From/To	*Seg 13-Bet Off & On Ramps*
Jurisdiction	
Analysis Year	*2020 Build 2A*

Project Description *SW 10th Street SIMR*

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4560*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1624*	pc/h/ln
S	*67.9*	mph
D = v_p / S	*23.9*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h/ln
S		mph
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

FREEWAY WEAVING WORKSHEET

General Information

Analyst	
Agency/Company	AECOM
Date Performed	
Analysis Time Period	PM

Site Information

Freeway/Dir of Travel	I-95 SB
Weaving Segment Location	Seg 14- Bet Sample & Copans
Analysis Year	2020 Build 2A

Project Description SW 10th Street SIMR

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	4	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	2520ft	Freeway maximum capacity, C_{IFL}	2400
Freeway free-flow speed, FFS	70 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	3915	0.95	3	0	1.5	1.2	0.985	1.00	4183
V_{RF}	1380	0.92	2	0	1.5	1.2	0.990	1.00	1515
V_{FR}	645	0.92	2	0	1.5	1.2	0.990	1.00	708
V_{RR}	0	0.95	0	0	1.5	1.2	1.000	1.00	0
V_{NW}	4183							V =	6406
V_W	2223								
VR	0.347								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	2223 lc/h
Interchange density, ID	0.7 int/mi	Weaving lane changes, LC_W	2672 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	1457 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	4129 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	738

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	6323 veh/h	Weaving intensity factor, W	0.334
Weaving segment capacity, c_w	6814 veh/h	Weaving segment speed, S	49.3 mph
Weaving segment v/c ratio	0.928	Average weaving speed, S_W	56.2 mph
Weaving segment density, D	32.5 pc/mi/ln	Average non-weaving speed, S_{NW}	46.3 mph
Level of Service, LOS	D	Maximum weaving length, L_{MAX}	6094 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-95 NB Express Lane
Agency or Company	AECOM	Junction	Off to SW 10th Connector
Date Performed		Jurisdiction	
Analysis Time Period	AM	Analysis Year	2020 Build 2A

Project Description SW 10th Street SIMR

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	2	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	345	L_{down} =	ft
V_u =	veh/h	Freeway Volume, V_F	1240	V_D =	veh/h
		Ramp Volume, V_R	180		
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	60.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	1240	0.95	Level	3	0	0.985	1.00	1325
Ramp	180	0.95	Level	2	0	0.990	1.00	191
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 1325 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	1325	Exhibit 13-8	4800	No
$V_{FO} = V_F - V_R$	1134	Exhibit 13-8	4800	No
V_R	191	Exhibit 13-10	2200	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	1325	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 12.5 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

D_S = 0.120 (Exhibit 13-12)

S_R= 66.6 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 66.6 mph (Exhibit 13-13)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-95 NB Express Lanes
Agency or Company	AECOM	Junction	On from SW 10th St. Connector
Date Performed		Jurisdiction	
Analysis Time Period	AM	Analysis Year	2020 Build 2A

Project Description SW 10th Street SIMR

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 1040	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 1060	
	Ramp Volume, V_R: 1120	
	Freeway Free-Flow Speed, S_{FF}: 70.0	
	Ramp Free-Flow Speed, S_{FR}: 60.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	1060	0.95	Level	3	0	0.985	1.00	1133
Ramp	1120	0.95	Level	2	0	0.990	1.00	1191
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 1133 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	2324	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2459	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 16.5 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

M_S = 0.242 (Exibit 13-11)

S_R = 63.2 mph (Exhibit 13-11)

S_0 = N/A mph (Exhibit 13-11)

S = 63.2 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R = mph (Exhibit 13-12)

S_0 = mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-95 SB Express Lane
Agency or Company	AECOM	Junction	Off to SW 10th Connector
Date Performed		Jurisdiction	
Analysis Time Period	AM	Analysis Year	2020 Build 2A

Project Description SW 10th Street SIMR

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	2	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	250	L_{down} =	ft
V_u =	veh/h	Freeway Volume, V_F	1110	V_D =	veh/h
		Ramp Volume, V_R	510		
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	60.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1110	0.95	Level	3	0	0.985	1.00	1186
Ramp	510	0.95	Level	2	0	0.990	1.00	542
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 1186 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	1186	Exhibit 13-8	4800	No
$V_{FO} = V_F - V_R$	644	Exhibit 13-8	4800	No
V_R	542	Exhibit 13-10	2200	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	1186	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 12.2 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

D_S = 0.152 (Exhibit 13-12)

S_R= 65.8 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 65.8 mph (Exhibit 13-13)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-95 SB Express Lanes
Agency or Company	AECOM	Junction	On from SW 10th St. Connector
Date Performed		Jurisdiction	
Analysis Time Period	AM	Analysis Year	2020 Build 2A

Project Description SW 10th Street SIMR

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 1100	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 600	
	Ramp Volume, V_R: 330	
	Freeway Free-Flow Speed, S_{FF}: 70.0	
	Ramp Free-Flow Speed, S_{FR}: 60.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	600	0.95	Level	3	0	0.985	1.00	641
Ramp	330	0.95	Level	2	0	0.990	1.00	351
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 641 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	992	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	1068	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = 6.2 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

M_S = 0.200 (Exibit 13-11)

S_R = 64.4 mph (Exhibit 13-11)

S_0 = N/A mph (Exhibit 13-11)

S = 64.4 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R = mph (Exhibit 13-12)

S_0 = mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information

Analyst		Freeway/Dir of Travel	I-95 NB Express Lane
Agency or Company	AECOM	Junction	Off to SW 10th Connector
Date Performed		Jurisdiction	
Analysis Time Period	PM	Analysis Year	2020 Build 2A

Project Description SW 10th Street SIMR

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	2	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	345	L_{down} =	ft
V_u =	veh/h	Freeway Volume, V_F	1040	V_D =	veh/h
		Ramp Volume, V_R	390		
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	60.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	1040	0.95	Level	3	0	0.985	1.00	1111
Ramp	390	0.95	Level	2	0	0.990	1.00	415
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 1111 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	1111	Exhibit 13-8	4800	No
$V_{FO} = V_F - V_R$	696	Exhibit 13-8	4800	No
V_R	415	Exhibit 13-10	2200	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	1111	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 10.7 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

D_S = 0.140 (Exhibit 13-12)

S_R= 66.1 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 66.1 mph (Exhibit 13-13)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-95 NB Express Lanes
Agency or Company	AECOM	Junction	On from SW 10th St. Connector
Date Performed		Jurisdiction	
Analysis Time Period	PM	Analysis Year	2020 Build 2A

Project Description SW 10th Street SIMR

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 1040	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 650	
	Ramp Volume, V_R: 580	
	Freeway Free-Flow Speed, S_{FF}: 70.0	
	Ramp Free-Flow Speed, S_{FR}: 60.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	650	0.95	Level	3	0	0.985	1.00	694
Ramp	580	0.95	Level	2	0	0.990	1.00	617
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 694 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	1311	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	1394	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 8.9 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

M_S = 0.212 (Exibit 13-11)

S_R = 64.1 mph (Exhibit 13-11)

S_0 = N/A mph (Exhibit 13-11)

S = 64.1 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R = mph (Exhibit 13-12)

S_0 = mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information

Analyst		Freeway/Dir of Travel	I-95 SB Express Lane
Agency or Company	AECOM	Junction	Off to SW 10th Connector
Date Performed		Jurisdiction	
Analysis Time Period	PM	Analysis Year	2020 Build 2A

Project Description SW 10th Street SIMR

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	2	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	250	L_{down} =	ft
V_u =	veh/h	Freeway Volume, V_F	1970	V_D =	veh/h
		Ramp Volume, V_R	760		
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	60.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1970	0.95	Level	3	0	0.985	1.00	2105
Ramp	760	0.95	Level	2	0	0.990	1.00	808
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 2105 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	2105	Exhibit 13-8	4800	No
$V_{FO} = V_F - V_R$	1297	Exhibit 13-8	4800	No
V_R	808	Exhibit 13-10	2200	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2105	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 20.1 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

D_S = 0.176 (Exhibit 13-12)

S_R= 65.1 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 65.1 mph (Exhibit 13-13)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-95 SB Express Lanes
Agency or Company	AECOM	Junction	On from SW 10th St. Connector
Date Performed		Jurisdiction	
Analysis Time Period	PM	Analysis Year	2020 Build 2A

Project Description SW 10th Street SIMR

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 1100	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 1210	
	Ramp Volume, V_R: 170	
	Freeway Free-Flow Speed, S_{FF}: 70.0	
	Ramp Free-Flow Speed, S_{FR}: 60.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	1210	0.95	Level	3	0	0.985	1.00	1293
Ramp	170	0.95	Level	2	0	0.990	1.00	181
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 1293 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	1474	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	1629	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 10.0 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

M_S = 0.209 (Exibit 13-11)

S_R = 64.2 mph (Exhibit 13-11)

S_0 = N/A mph (Exhibit 13-11)

S = 64.2 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R = mph (Exhibit 13-12)

S_0 = mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information

Analyst		Freeway/Dir of Travel	I-95 NB CD
Agency or Company	AECOM	Junction	N. of Hillsboro Blvd.
Date Performed		Jurisdiction	
Analysis Time Period	AM	Analysis Year	2020 Build 2A

Project Description SW 10th Street SIMR

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 890	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 1220	
	Ramp Volume, V_R: 710	
	Freeway Free-Flow Speed, S_{FF}: 55.0	
	Ramp Free-Flow Speed, S_{FR}: 40.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	1220	0.95	Level	3	0	0.985	1.00	1303
Ramp	710	0.95	Level	2	0	0.990	1.00	755
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 1303 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	2058	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2058	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 15.6 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

M_S = 0.280 (Exibit 13-11)

S_R = 51.4 mph (Exhibit 13-11)

S_0 = N/A mph (Exhibit 13-11)

S = 51.4 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R = mph (Exhibit 13-12)

S_0 = mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-95 NB CD
Agency or Company	AECOM	Junction	N. of Hillsboro Blvd.
Date Performed		Jurisdiction	
Analysis Time Period	PM	Analysis Year	2020 Build 2A

Project Description SW 10th Street SIMR

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Freeway Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Ramp Number of Lanes, N: 1	☑ No ☐ Off
L_{up} = ft	Acceleration Lane Length, L_A: 890	L_{down} = ft
V_u = veh/h	Deceleration Lane Length L_D:	V_D = veh/h
	Freeway Volume, V_F: 1515	
	Ramp Volume, V_R: 620	
	Freeway Free-Flow Speed, S_{FF}: 55.0	
	Ramp Free-Flow Speed, S_{FR}: 40.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	1515	0.95	Level	3	0	0.985	1.00	1619
Ramp	620	0.95	Level	2	0	0.990	1.00	659
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 using Equation (Exhibit 13-6)

V_{12} = 1619 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	2278	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2278	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = 17.4 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

M_S = 0.288 (Exibit 13-11)

S_R = 51.3 mph (Exhibit 13-11)

S_0 = N/A mph (Exhibit 13-11)

S = 51.3 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R = mph (Exhibit 13-12)

S_0 = mph (Exhibit 13-12)

S = mph (Exhibit 13-13)